Rideau Lakes Subwatershed Report 2014
BIG RIDEAU LAKE – PORTLAND CATCHMENT

RIDEAU VALLEY CONSERVATION AUTHORITY

The RVCA produces individual reports for eight catchments in the Rideau Lakes subwatershed. Using data collected and analysed by the RVCA through its watershed monitoring and land cover classification programs, surface water quality conditions are reported for Big Rideau Lake along with a summary of environmental conditions for the surrounding countryside every six years.

This information is used to better understand the effects of human activity on our water resources, allows us to better track environmental change over time and helps focus watershed management actions where they are needed the most.

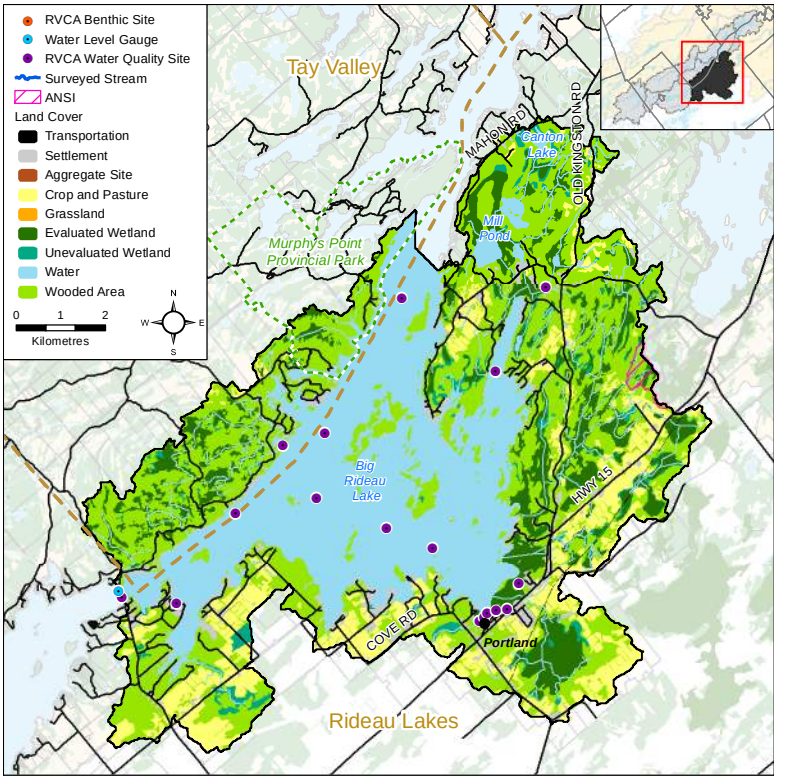
The following pages of this report are a compilation of that work. For other Rideau Lakes catchments and the Rideau Lakes Subwatershed Report, please visit the RVCA website at www.rvca.ca

What's Inside

Catchment Facts

General Geography

- The Rideau Lakes are a very popular seasonal tourist and residential destination because of its diverse natural amenity, cultural history associated with the UNESCO World Heritage Site designated Rideau Canal, close proximity to a number of large cities and towns and ease of access via the Rideau Canal. Residents and vacationers flock to Rideau Lakes in the summer to take advantage of its natural heritage and recreational opportunities such as boating, fishing and swimming. Cottages, houses, campgrounds, B&Bs and marinas stretch extensively along the shoreline that was once largely untouched, putting pressure on the natural resources that support the Rideau Lakes many uses and users



- Newboro, Portland, Rideau Ferry and Westport are the main settlement areas in the Rideau Lakes subwatershed. Of these, only Portland is located in the Big Rideau (Portland) catchment and is a service centre for local residents. It is also a major boating centre in the Rideau Lakes offering marina services along with other services and is one of the main gateways for visitors to access the Rideau Lakes
- Parks Canada manages water levels for recreational purposes along the Rideau Canal/Waterway (also designated a National Historic Site and a Canadian Heritage River) that runs through the catchment, ensuring 1.5 metres of draft during the navigation season. In this managed system, water levels on the Rideau Canal are manipulated by operation of numerous dams. In the Rideau Lakes subwatershed, Parks Canada staff operate dams at Wolfe Lake, the Narrows on Upper Rideau and Poonamalie at the outlet of Lower Rideau Lake. The dams on Westport Sand Lake and Westport Pond are operated by the Ministry of Natural Resources and Forests in cooperation with Parks Canada. Water levels are lowered in October throughout the Canal system to the winter operating level that is maintained until early March when snow, ice and precipitation data are used to estimate spring snow melt conditions. At the onset of the spring freshet, water levels are targeted using a rule curve (i.e. a pre-determined estimate of water levels to ensure a "best fit" to prevent as much as possible high and low levels). In late May, levels are at the maximum for the beginning of the navigation season. Levels decline gradually throughout the summer until the winter level is reached once again. The annual range of operational water levels on the lakes is in the order of one metre

- Rideau Lakes form part of the Frontenac Arch Biosphere Reserve (Frontenac Axis), an important intra-regional landscape feature which supports a wide variety of species and their movements between Algonquin Park in Central Ontario and Adirondack Park in Upper New York State
- Big Rideau Lake (Portland catchment) has many embayments including Bass, Beaver, Briton, Green, Horseshoe, Houghton, Hudson, MacDonalds, Mill, Murphys, Narrows, Sheldons and Sherwoods Bay

Physical Geography

- Most of the Big Rideau Lake-Portland catchment and the majority of the Rideau Lake subwatershed primarily resides within the Algonquin Highlands, which is an ancient (Precambrian) hilly area made up of thin and variable glacial deposits overlying igneous and metamorphic rock ridges and knolls. In this catchment, these rocks are marble or gneiss/granite
- The southern extent of Big Rideau Lake-Portland catchment is located within a physiographic region known as the Smith Falls Limestone Plain which, in this area, happens to consist of older Paleozoic quartzose sandstone, some dolostone and possibly conglomerates, all of which are overlain by mixed glacial sediment often referred to as drift. Rocks associated with geologic faults are also found in this catchment. Organic deposits are also found throughout this type of terrain where swamps, fens and bogs are situated. Geologic faults, oriented northeast and east from the Narrows, transect the lake and a drumlin is located near the Old Kingston and Briton Houghton Bay Roads
- Eighty-four percent of the catchment lies within the Township of Rideau Lakes and 16 percent within Tay Valley Township
- Big Rideau-Portland catchment drainage area is 107 square kilometres and occupies about 24 percent of the Rideau Lakes subwatershed and less than three percent of the Rideau Valley watershed
- Dominant land cover is woodland (36 percent) and water (30 percent) followed by wetland (15 percent), crop and pastureland (12 percent), settlement areas (four percent) and transportation routes (three percent)

Vulnerable Areas

- Certain lands around Big Rideau Lake are subject to flooding hazard during the regional storm flood (the 100 year flood) conditions in the area. Surveys and studies undertaken in accordance with provincial standards have determined that the 100 year flood elevation for the lake is 124.51 metres above mean sea level
- The Assessment Report developed under the Ontario *Clean Water Act,* identified the catchment area as Highly Vulnerable Aquifer and a portion of the area is considered to be a Significant Groundwater Recharge Area

Development/Trends

- Given the proximity to the serviced communities of Perth, Portland, Rideau Ferry and Smiths Falls, (which have a mix of residential, commercial and institutional uses), there is added pressure for other residential development beyond existing settlement areas in the Rural zoned areas around Big Rideau Lake
- Much of this development will continue to occur along waterfronts, as it has in the past. While many lakes have been developed to the extent that the physiography of the region will allow, others still have some development potential. In some cases, new lot development can occur only on marginal lands (steep slopes, shallow soils, narrow waterfronts, low lying poorly-drained lands) as the remaining lands have been fully developed
- Most development activity is focused around redevelopment, where cottages are being replaced with large permanent residences on small lots. This can put additional stress on the lake environment because large development envelopes on smaller lots leave less space for natural processes (e.g., runoff, infiltration and retention, nutrient uptake, erosion control and shading) and natural features (e.g., trees, shrubs and plants) that support a healthy lake environment. Minor variances are frequently triggered because the lots do not have sufficient area to provide for a minimum 30 metre development setback from the lake
- Development in the Tay Valley Township area of the catchment consists largely of new cottages or conversions of cottages to permanent residences around Big Rideau Lake with access provided by a private road – the Big Rideau North Shore Road. Current land-use zoning is mostly Seasonal Residential or Residential Limited Services.
- In the Township of Rideau Lakes, beyond Portland, development consists largely of new cottages and year round homes or conversions of cottages to permanent residences with access provided by a combination of public and private roads to Big Rideau Lake. The zoning is predominately Waterfront Residential and Rural

Conditions at a Glance

- Surface water quality rating in the Big Rideau Lake-Portland catchment is ”Fair” and ”Poor” along Sheldons Creek flowing into Little Lake located northeast of Portland
- Woodland cover proportion has changed/increased by one percent (154 ha) from 2002 to 2008, due to a combination of changes in land cover/land uses and/or applied digital air photo classification methods
- In the Big Rideau Lake-Portland catchment, the riparian buffer (30 metre wide strip along the shoreline of all lakes and streams) is comprised of woodland (48 percent), wetland (37 percent), settlement areas (nine percent), crop and pastureland (four percent), and transportation routes (two percent). Around **Big Rideau Lake** (in the Portland catchment), the shoreline buffer is made up of woodland (69 percent), settlement areas (24 percent), wetland (four percent), transportation routes (two percent) and crop and pastureland (one percent). Along streams, the riparian buffer is comprised of wetland (52 percent), woodland (35 percent), crop and pastureland (nine percent), settlement areas (two percent) and transportation routes (two percent) throughout the whole catchment
- Development on Big Rideau Lake and in Portland occurs on private wells (of which there are about 775 water well records in the catchment) and septic systems
- One groundwater monitoring well is located at the RVCA Conservation Area in Portland (part of the Provincial Groundwater Monitoring Network). Groundwater levels and some water quality data can be obtained for this well (www.ontario.ca/environment-and-energy/provincial-groundwater-monitoring-network)
- Since 1987, Big Rideau Lake has been managed as a Class One, cold water lake that can support natural reproduction of important sport fish species such as lake trout. Big Rideau Lake has been stocked (with nine different fish species, but mainly with lake trout, over the last 100 years). Stocking ceased entirely in 2009 because it was determined that the practice was introducing too much intra-specific stress on the native population (to the point that more and more stocked fish were showing up on spawning shoals). The only remaining Rideau Lakes stocking takes place on Westport Sand Lake where walleye is stocked annually by the Westport Area Outdoors Association
- 2009 OMNRF fish population survey of Big Rideau Lake Fisheries Management Zone 18 identified 20 large mesh net species: pumpkinseed (19%), yellow perch (17%), brown bullhead (13%), cisco (11%), alewife (7%), rock bass (6%), northern pike (6%), smallmouth bass (5%), bluegill (5%), lake trout (4%), lake whitefish (3%), largemouth bass (2%), black crappie, burbot, walleye, white sucker

(2%) and four small mesh net species: gizzard shad, golden shiner, ninespine stickleback and sand shiner
- Commercial fishery quotas and conditions for the last several years on Upper, Big and Lower Rideau Lakes have remained the same with one exception on Upper Rideau where OMNRF has increased the yellow perch quota based on the 2013 assessment. OMNRF fisheries research specialists confirm that inland commercial fishery quotas on the Rideau Lakes system are sustainable

Catchment Care
- Since 2000, RVCA monitors Big Rideau Lake surface water quality through its Watershed Watch Program. In 2006, the program was altered to gain consistent, year to year data for the set of lakes being monitored. In response to the *2009 Rideau Lakes Watershed Plan* action to "Develop a more intensive and coordinated water quality monitoring program for the Rideau Lakes," RVCA monitors surface water quality four times of the year at three deep point sites and twice a year at 14 sites on Big Rideau Lake. In total, twelve samples are taken at the lake deep point and 28 samples along the shoreline annually
- RVCA provides septic system re-inspection at the request of the Township of Rideau Lakes (since 2007) and Tay Valley Township (since 2004)
- Tay Valley Township septic system voluntary re-inspections were undertaken on 97 Big Rideau Lake properties in the catchment by the Mississippi Rideau Septic System Office. Remedial/maintenance work was advocated for 47 of those properties, septic system replacements at another three properties with more information supplied to a further nine landowners with septic system concerns
- Township of Rideau Lakes septic system voluntary re-inspections were undertaken on 76 Big Rideau Lake properties in the catchment by the Mississippi Rideau Septic System Office. Remedial/maintenance work was advocated for 32 of those properties, septic system replacements at another four properties with more information supplied to one other landowner with identified septic system concerns (a further eight properties with concerns do not have any specific remedial measures attached to them)
- Thirty-four stewardship projects have been completed through RVCA's Private Land Forestry, Rural Clean Water and Shoreline Naturalization Programs (please see Section 4 of this report for details)
- RVCA completed littoral zone mapping around Big Rideau Lake and Mill Pond in 2013, identifying substrate type, vegetation and habitat features along with opportunities for shoreline enhancements
- The Big Rideau Lake Association has worked for many decades to enhance the social community and natural environment of the Rideau Lake system by providing ongoing activities and programs for residents living along its shores from the Narrows Lock to Poonamalie (visit Big Rideau Lake Association for more information)
- Three Permits to Take Water (PTTW) have been issued to Ducks Unlimited Canada to permit the ponding/storage of surface waters, in order to create wetland conditions for wildlife conservation projects
- A watershed model developed by the RVCA in 2009 was used to study the hydrologic function of wetlands in the Rideau Valley watershed, including those found in the Big Rideau Lake-Portland catchment
- RVCA provides flood forecasting and warning services throughout the Rideau Valley watershed. In the Upper Rideau subwatershed, only general flooding information has been made available historically for the lakes. In 2014, lake levels were higher than most years and more attention was required from RVCA and municipal staff, resulting in the decision to review what the flood forecasting and warning program provides to the Upper Rideau Valley
- Tay Valley Township and Rideau Lakes Township have land use planning policies and zoning provisions (on lake capacity, water setbacks, frontage, naturalized shorelines and wetland protection) and use site plan control to implement these policies and provisions. Together with RVCA and Parks Canada, they work with landowners on a case by case basis to achieve net environmental gains (particularly with respect to shoreline vegetation protection and rehabilitation) through the use of shoreline best management practices. Collectively, the Townships and the agencies request conditions on planning approvals to ensure that development and redevelopment is appropriate for the property, impacts on neighbours are minimized (particularly on very small lots) and development setbacks for the shoreline are maximized
- Development in and adjacent to Provincially Significant Wetlands and some locally significant wetlands is subject to Ontario Regulation 174-06 (entitled "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses") that protects the hydrologic function of the wetland and also protects landowners and their property from natural hazards (flooding, fluctuating water table, unstable soils) associated with them
- *Rideau Lakes Basin Carrying Capacity Study* (1992) evaluated the capacity of the Rideau Lakes to support development with respect to lake trophic state (level of phosphorus and chlorophyll a) and shoreline development. Results have been used to provide land-use planning policy direction and guidance (in the form of a site evaluation guideline) to the municipalities of Rideau Lakes and Tay Valley and the Conservation Authority. Using phosphorus as the determinant for lake capacity, the study attempted to identify how much development was permissible to retain the "no net loss" in water quality principle (i.e., no net increase in phosphorus loading). Recommendations from it included the need to set water quality targets for each lake of concern, requiring buildings to be set no closer than 30 metres from water (with greater widths being recommended in areas with poor phosphorus retention based on soil type, slope and geological conditions), minimizing disturbance to shoreline vegetation and no alteration to the soil mantle within the protective setback area. An update to the abovementioned site evaluation guide is currently underway and is to be made available in 2015
- OMNRF conducts Broad-scale Monitoring of the Big Rideau Lake fishery on a five year rotation within Fisheries Management Zone 18 to provide information for effective fisheries management
- Parks Canada attempts to incorporate the breeding and habitat needs of fish and wildlife when determining water levels, flows and timing of drawdowns in the Rideau Lakes. For more information, please refer to the "Operating Rule Curve" for Big Rideau Lake available (at www.rvca.ca) in the *2014 Rideau Lakes Subwatershed Report* section on "Water Levels"
- *Rideau Canal National Historic Site of Canada Management Plan* (2005) update establishes the long term strategic direction for the management of the Rideau Canal
- *Rideau Canal World Heritage Site Management Plan* (2005) specifies how its world heritage values will be protected for present and future generations
- *2002 Rideau Lake State of the Lake Report* (Centre for Sustainable Watersheds) seeks to give a backdrop of understanding of the lake and the natural forces and past human activities that have shaped it
- Most of the shoreline of Big Rideau Lake is held in private ownership, so that the best opportunity for shoreline restoration/enhancement rests with private landowners. RVCA offers its Shoreline Naturalization Program to Rideau Lakes landowners to assist with shoreline re-vegetation (an enhanced delivery program has been put into place in response to the *2009 Rideau Lakes Watershed Plan* action to "Increase funding for the RVCA Shoreline Naturalization Program")

1. Surface Water Quality Conditions

Surface water quality conditions in the Big Rideau Lake-Portland Catchment are monitored by the Rideau Valley Conservation Authority's (RVCA) Watershed Watch Program and Baseline Water Quality Monitoring Program. Watershed Watch monitors lakes to assess nutrient concentrations, water clarity, dissolved oxygen availability and pH. The Baseline Water Quality Program focuses on streams; data is collected for 22 parameters including nutrients (total phosphorus, total Kjeldahl nitrogen and ammonia), *E. coli,* metals (like aluminum and copper) and additional chemical/physical parameters (such as alkalinity, chlorides, pH and total suspended solids). The location of monitoring sites is shown in Figure 1.

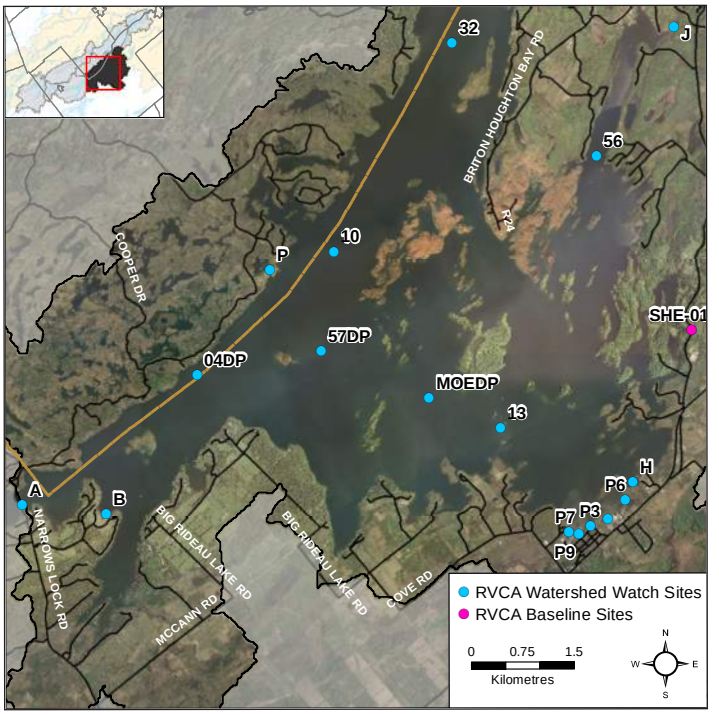


Figure 1 Water quality monitoring sites in the Big Rideau Lake-Portland catchment

The water quality ratings for the Big Rideau Lake-Portland catchment range from "Poor" to "Fair" (Table 1), as determined by the Canadian Council of Ministers of the Environment (CCME) Water Quality Index. Each parameter is evaluated against established guidelines to determine water quality conditions. Those parameters that frequently exceed guidelines are presented below. There is limited data available for Big Rideau Lake prior to 2005; therefore, only the 2008-2013 data is considered in this report. For the monitoring site located on Sheldons Creek (SHE-01), data analysis has been broken into two periods, 2002 to 2007 and 2008 to 2013, to examine if conditions have changed between these periods. Table 1 shows the overall rating for the monitored surface water quality sites within the Big Rideau-Portland catchment and Table 2 outlines the Water Quality Index (WQI) scores and their corresponding ratings.

Table 1 WQI Ratings for Big Rideau Lake-Rideau Ferry catchment

Sampling Site	Location	2002-2007	Rating
RVL-39	Big Rideau Lake (3 deep water sites)	NA	
SHE-01	Sheldons Creek at Old Kingston Rd	61	Poor
Sampling Site	**Location**	**2008-2013**	**Rating**
RVL-39	Big Rideau Lake (3 deep water sites)	77	Fair
SHE-01	Sheldons Creek at Old Kingston Rd	63	Poor

Table 2 WQI Ratings and corresponding index scores (RVCA terminology, original WQI category names in brackets)

Rating	Index Score
Very good (Excellent)	95-100
Good	80-94
Fair	65-79
Poor (Marginal)	45-64
Very poor (Poor)	0-44

1) a. Big Rideau Lake Water Quality

Surface water quality conditions in Big Rideau Lake have been monitored by RVCA's Watershed Watch Program since 2005. Data from three deep point sites has been used to calculate the WQI rating for Big Rideau Lake, which was determined to be "Fair" (Table 1). Relatively few nutrient exceedances, good oxygen conditions for fish habitat, clear water and occasionally elevated pH levels contributed to the rating. The following discussion explains how each of the monitored water quality parameters contributes to the lake's water quality.

This report also considers data from 14 additional sites that are regularly monitored around the lake. These sites have not been included in the calculation of the CCME WQI rating as they are not monitored with the same frequency as deep point sites. However, they do provide important information on water quality conditions in the near shore areas. For locations of shoreline sites, please see Figure 1.

The *2009 Rideau Lakes Watershed Plan-Recommendations* (RVCA, 2009) stated that Big Rideau Lake was in good ecological health but showed signs of stress resulting from recreational use, climate change and development pressure. The data presented in this report indicates that this continues to be the case and that a proactive cautionary program of best management practices is important to ensure the protection of the lake environment.

Nutrients

Total phosphorus (TP) is used as a primary indicator of excessive nutrient loading and may contribute to abundant aquatic vegetation growth and depleted dissolved oxygen levels. The Provincial Water Quality Objective (PWQO) is used as the TP Guideline and states that in lakes concentrations greater than 0.020 mg/l indicate an excessive amount of TP within the water column.

Total Kjeldahl nitrogen (TKN) is used as a secondary indicator of nutrient loading. RVCA uses a guideline of 0.500 mg/l to assess TKN[1] within surface waters.

At the Deep Points

Three deep point sites are monitored within this catchment. Average nutrient concentrations at these sites is summarized in Table 3, as well as the proportion of results that meet the guideline.

Table 3 Summary of nutrient results for Big Rideau Lake (Portland catchment) 2008-2013

Total Phosphorus 2008-2013			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
RVL-39	0.009	97%	66
Total Kjeldahl Nitrogen 2008-2013			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
RVL-39	0.331	100%	66

TP and TKN sampling results are presented in Figures 2 and 3. The majority (97 percent) of samples analyzed for TP were less than the TP guideline and the average concentration was 0.009 mg/l (Table 3). TKN concentrations were also minimal; all reported results were below the TKN guideline as was the average concentration at 0.331 mg/l (Table 3). Average year to year concentrations have varied for both TP and TKN (Figure 4 and 5) but do not indicate a general trend; all average results are below guidelines. Overall the data presented indicates that nutrient enrichment is not a significant concern in the mid-lake, deep water sites of Big Rideau Lake.

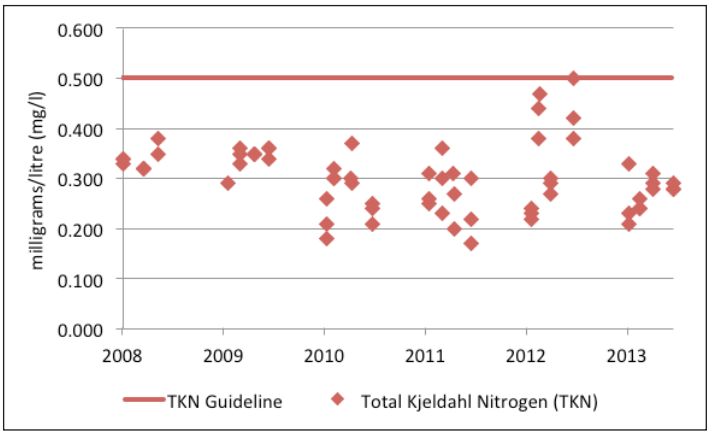


Figure 3 Total Kjeldahl nitrogen sampling results at deep point sites in Big Rideau Lake (Portland catchment), 2008-2013

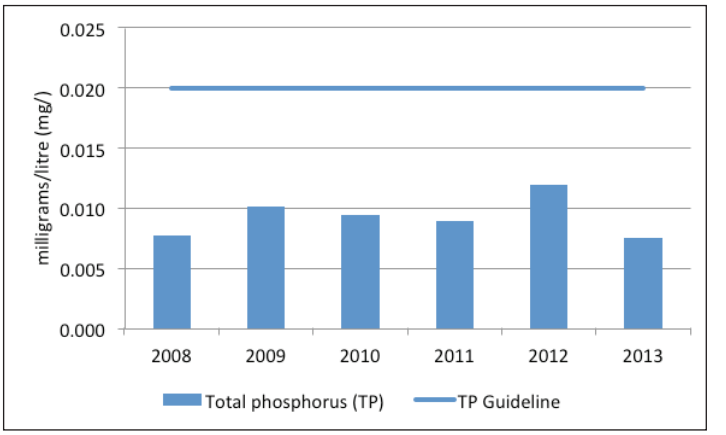


Figure 4 Average total phosphorus at deep point sites in Big Rideau Lake (Portland catchment), 2008-2013

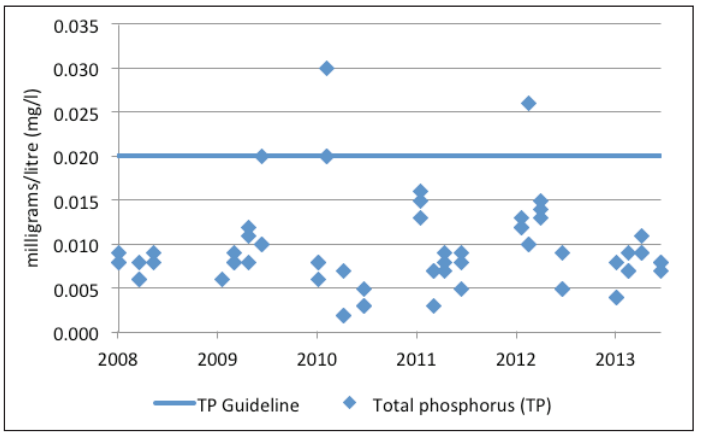


Figure 2 Total phosphorus sampling results at deep point sites in Big Rideau Lake (Portland catchment), 2008-2013

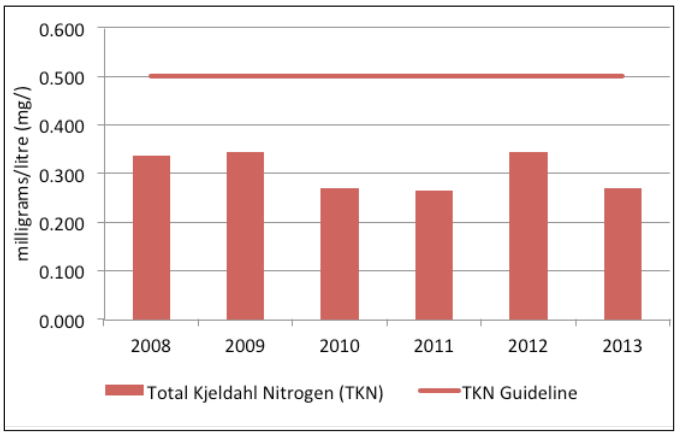


Figure 5 Average total Kjeldahl nitrogen at deep point sites in Big Rideau Lake (Portland catchment), 2008-2013

[1] No Ontario guideline for TKN is presently available; however, waters not influenced by excessive organic inputs typically range from 0.100 to 0.500 mg/l, Environment Canada (1979) Water Quality Sourcebook, A Guide to Water Quality Parameters, Inland Waters Directorate, Water Quality Branch, Ottawa, Canada

Around the Lake

The average nutrient concentrations at monitored sites around the lake vary from year to year (Figures 6 and 7). Please note that sites 10, 13, 32, 56, A, P10, P3, P6, P7 and P9 are monitored each year while other sites are monitored every fifth year.

Total phosphorous concentrations are below the TP guideline at the majority of sites with the exception of sites A, P10 and P6, which have all exceeded the guideline in more than one year (Figure 6). Site A is located near Narrows Locks and may be influenced by the inflow from Upper Rideau Lake as well as increased boat and vehicular traffic. In shallow waters, active boating may stir the water column and cause re-suspension of nutrient rich sediment. Site P6 and P10 are located in Mill Bay at Portland. The impacts of increased shoreline development, stormwater runoff, boat traffic and high levels of recreational use in this shallow Bay may contribute to increased loading and re-suspension of sediment resulting in higher TP concentrations.

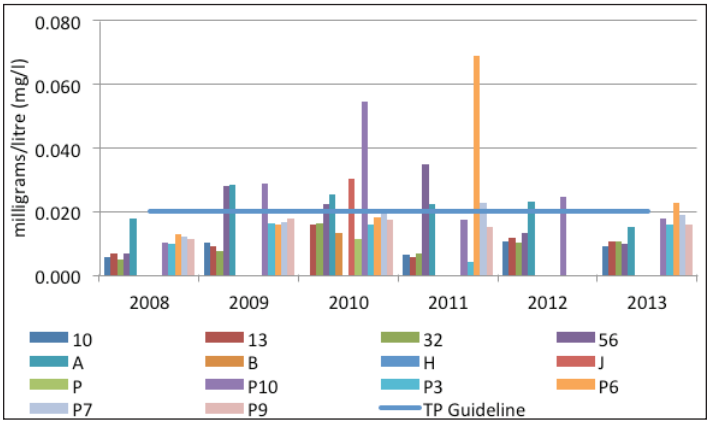


Figure 6 Average total phosphorus concentration at additional monitoring sites on Big Rideau Lake (Portland catchment), 2008-2013

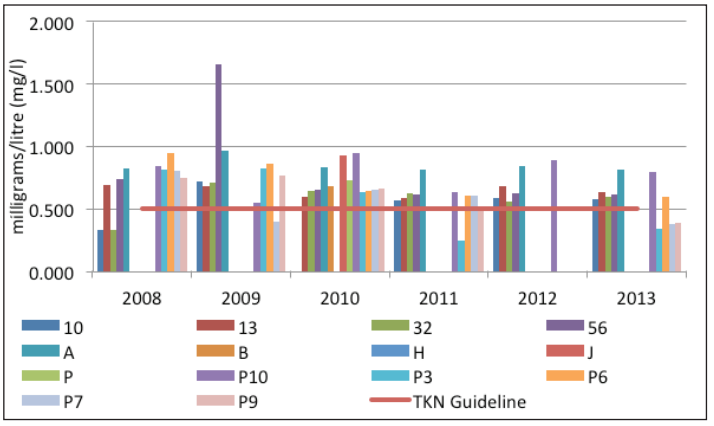


Figure 7 Average total Kjeldahl nitrogen concentration at additional monitoring sites on Big Rideau Lake (Portland catchment), 2008-2013

Summary

Within Big Rideau Lake (Portland catchment) nutrient concentrations generally meet guidelines with the exception of some near shore areas. TP concentrations are comparable to the *2002 State of the Lake Report* (Centre for Sustainable Watersheds) which noted that TP typically fell between 0.01 mg/l to 0.02 mg/l and TKN was below 0.500 mg/l.
Sites with particularly high results should be further investigated to determine if sources of nutrient inputs can be reduced through the diversion of runoff and enhanced shoreline buffers. Areas where high concentrations of nutrients are persistent may observe excessive aquatic plant growth, algae blooms and depleted oxygen concentrations. Nutrient exceedances may be partially attributed to the natural aging of a lake, but can be slowed with the help of all lake residents by reducing nutrient inputs through practices such as proper maintenance of septic systems, keeping shorelines natural and using phosphate free soaps and detergents.

Water Clarity

Water clarity is measured using a Secchi disk during each deep point sample. Table 4 summarizes the recorded depths and shows that all readings have exceeded the minimum PWQO of 2 metres and the average Secchi depth of 7.5 metre. Figure 8 shows that no individual reading has been below the guideline and measured depths range from 4.5 metres to 10.5 metres. It should also be noted that Secchi depths in many waterbodies have been influenced by the colonization of zebra mussels resulting in clearer waters than may have been seen prior to the introduction of this species.

Summary

This data indicates that waters are very clear and sufficient sunlight is able to penetrate the water column to support aquatic life and provide sufficient visibility for safe recreational use (i.e. boating, swimming).

Table 4 Summary of Secchi depths recorded at deep points in Big Rideau Lake (Portland catchment), 2008-2013

Secchi depth 2008-2013			
Site	**Average (m)**	**Above Guideline**	**No. Samples**
RVL-39	7.5	100%	64

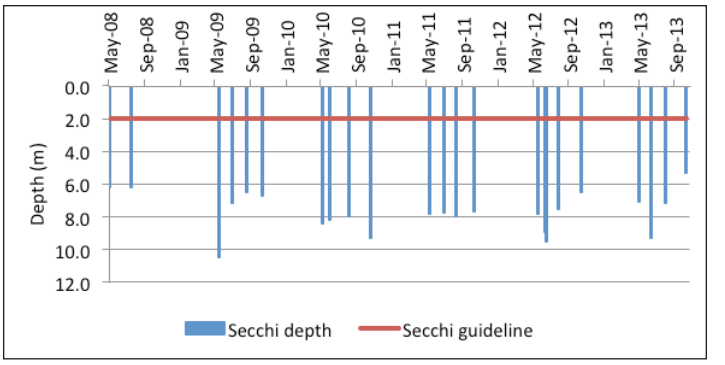


Figure 8 Recorded Secchi depths at deep point sites in Big Rideau Lake (Portland catchment), 2008-2013

Fish Habitat

Two other factors, dissolved oxygen/temperature and pH were also assessed to provide an overall sense of the health of Big Rideau Lake from a fish habitat perspective.

Dissolved Oxygen and Temperature

The red bars in Figures 9, 10 and 11 show the depths where suitable conditions exist for warm water fish species (temperature less than 25°C and dissolved oxygen greater than 4 mg/l) at the three monitored deep points. The vertical axis represents the total lake depth at each site where the profile is taken. Suitable oxygen temperatures exist to an average depth of 33 metre at site RVL-39-04 (Figure 9), 30 metre at site RVL-39-57 (Figure10) and 18 metre at site RVL-39-MOE (Figure 11).

Optimal conditions for lake trout habitat (temperature less than 10°C and dissolved oxygen greater than 7 mg/l) are also shown by the blue points. Spring and early summer typically have good conditions for lake trout habitat but as temperatures warm throughout the summer available habitat becomes more limited; particularly in the shallower site RVL-39-MOE.

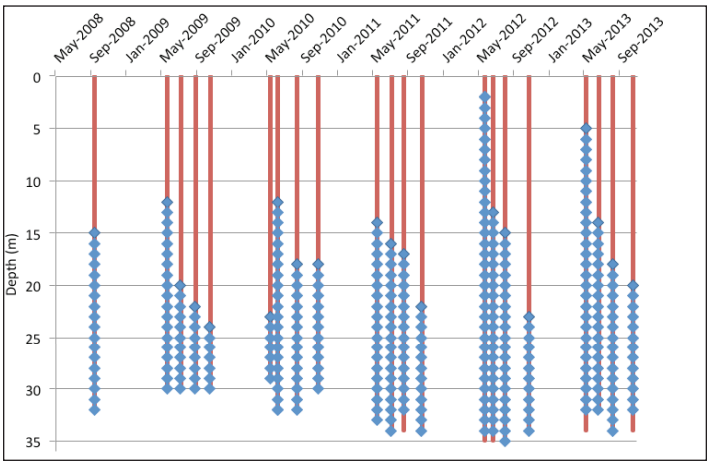


Figure 9 Depths suitable for warm water fish (red bars) and lake trout (blue points) at site RVL-39-04 in Big Rideau Lake (Portland catchment)

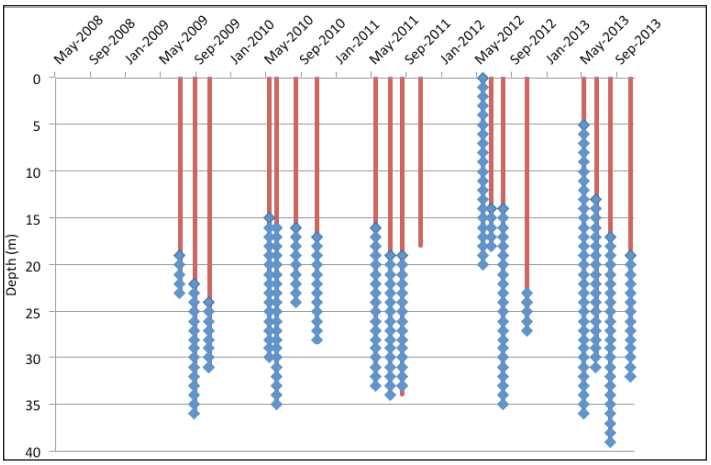


Figure 10 Depths suitable for warm water fish (red bars) and lake trout (blue points) at site RVL-39-57 in Big Rideau Lake (Portland catchment)

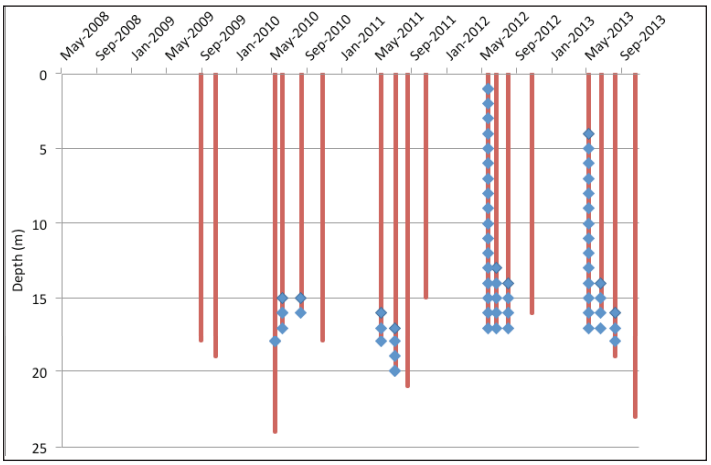


Figure 11 Depths suitable for warm water fish (red bars) and lake trout (blue points) at site RVL-39-MOE in Big Rideau Lake (Portland catchment)

pH

pH is a basic water quality parameter used to assess the acidity of water, an important factor for aquatic life. Figure 12 shows pH concentrations in Big Rideau Lake (Portland catchment) and Figure13 summarizes average concentrations by year.

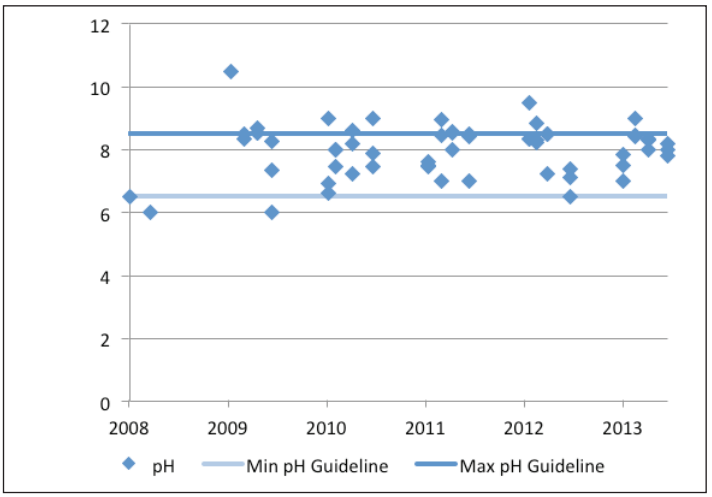


Figure 12 pH concentrations at the deep points in Big Rideau Lake (Portland catchment)

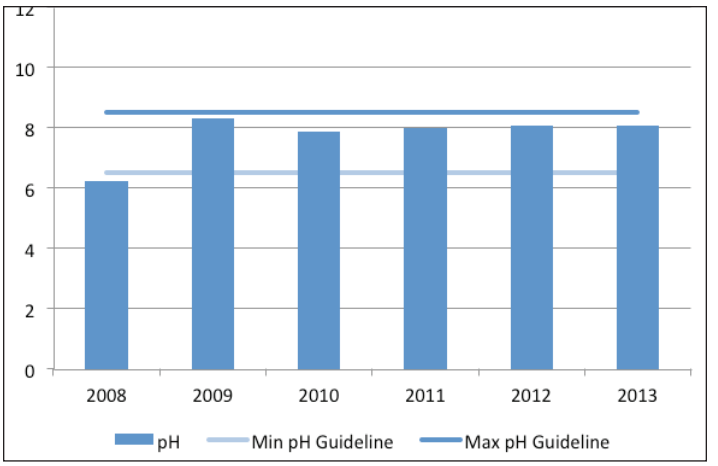


Figure 13 Average pH concentrations at the deep points in Big Rideau Lake (Portland catchment)

Seventy-three percent of samples (Table 5) were within guidelines established by the PWQO which state that pH should be between 6.5 and 8.5 to protect aquatic life and prevent irritation for anyone using the waters for recreational purposes.

Table 5 Summary of pH results for deep point sites in Big Rideau Lake (Portland catchment)

pH 2008–2013			
Site	**Average**	**% that meet guideline**	**No. Samples**
RVL-39	7.99	73%	59

In some areas of the Rideau Lakes subwatershed, surface waters tend to be a bit more alkaline (higher pH) which can generally be attributed to geology rather than anthropogenic activities; biological activities such as photosynthesis may also affect pH. The variation in sampled pH concentrations is minimal from 2008-2013 (Figure 13).

Summary

Overall, the water chemistry data at the deep points describes good habitat conditions for warm and cold water fish species. There is some evidence that the warming of the water column in the late summer/early fall may limit the amount of habitat for sensitive cold water species such as lake trout. pH conditions are typically within the range recommended for the protection of aquatic life, indicating a healthy environment for aquatic species.

E. coli

E. coli is sampled at monitored shoreline sites, twice each sampling season. These sites have not been included in the calculation of the CCME WQI rating as they are not monitored with the same frequency as deep point sites. Ninety-eight percent of samples were below the *E. coli* guideline of 100 colony forming units (CFU) per 100 ml set by the PWQO; across the lake the count at the geometric mean[2] was only 4 CFU/100ml (Table 6). Figure 14 shows that samples across all sites were well below the guideline.

Table 6 Summary of *E. coli* results for Big Rideau Lake from 2008-2013

***E. coli* 2008–2013**			
Site	**Geometric mean (CFU/100ml)**	**Below Guideline**	**No. Samples**
RVL-39	4	98%	100

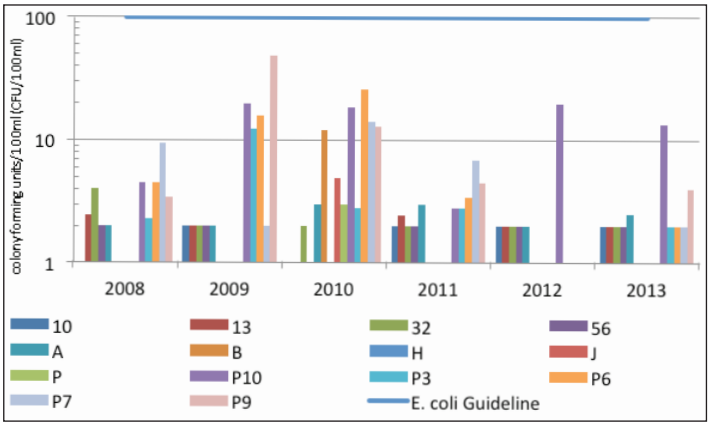


Figure 14 Geometric mean of shoreline sites monitored for *E. coli* on Big Rideau Lake (Portland catchment)

Summary

The results presented above provide evidence that bacterial contamination is not a significant concern in Big Rideau Lake and the water should be safe for recreational use such as swimming and boating.

[2] A type of mean or average, which indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). It is often used to summarize a variable that varies over several orders of magnitude, such as *E. coli* counts

1) b. Sheldons Creek Water Quality

There is one stream site on Sheldons Creek monitored in the Big Rideau Lake-Portland catchment (SHE-01, Figure 1). Analysis of the data is presented for two periods, 2002 - 2007 and 2008 - 2013, to examine if conditions have changed within this timeframe. Water quality at this site is reported as "Poor" (Table 1); the score at this site is largely influenced by high nutrient concentrations. For more information on the CCME WQI, please see the *2014 Rideau Lakes Subwatershed Report.*

Nutrients

Total phosphorus (TP) is used as a primary indicator of excessive nutrient loading and may contribute to abundant aquatic vegetation growth and depleted dissolved oxygen levels. The Provincial Water Quality Objective (PWQO) is used as the TP Guideline and states that in streams, concentrations greater than 0.030 mg/l indicate an excessive amount of TP.

Total Kjeldahl nitrogen (TKN) and ammonia (NH_3) are used as secondary indicators of nutrient loadings. RVCA uses a guideline of 0.500 mg/l to assess TKN[3] and the PWQO of 0.020 mg/l to assess ammonia concentrations at the monitored site.

Tables 7, 8 and 9 summarize average nutrient concentrations at the monitored site on Sheldons Creek and show the proportion of results that meet the guidelines.

Table 7 Summary of total phosphorus results in Sheldons Creek from 2002-2007 and 2008- 2013. Highlighted values indicate average concentrations exceed the guideline

Total Phosphorus 2002–2007			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	0.070	22%	32
Total Phosphorus 2008-2013			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	0.147	33%	39

Table 8 Summary of total Kjeldahl nitrogen results in Sheldons Creek from 2002-2007 and 2008-2013. Highlighted values indicate average concentrations exceed the guideline

Total Kjeldahl Nitrogen 2002–2007			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	1.251	22%	32
Total Kjeldahl Nitrogen 2008-2013			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	1.652	3%	65

Table 9 Summary of ammonia results in Sheldons Creek from 2002-2007 and 2008-2013. Highlighted values indicate average concentrations exceed the guideline

Ammonia 2002–2007			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	0.051	25%	32
Ammonia 2008-2013			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
SHE-01	0.062	56%	39

The majority of samples at SHE-01 exceeded the TP guideline; only 22 percent of samples were below the guideline in the 2002-2007 period (Figure 15). This improved to 33 percent of samples in the 2008-2013 period (Figure 16). Though the proportion of samples below the guideline improved, average TP concentration increased from 0.070 mg/l (2002-2007) to 0.147 mg/l (2008-2013).

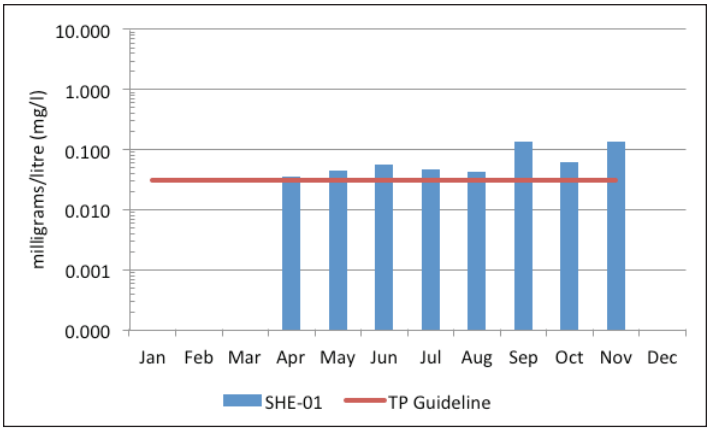


Figure 15 Total phosphorus concentrations in Sheldons Creek from 2002-2007

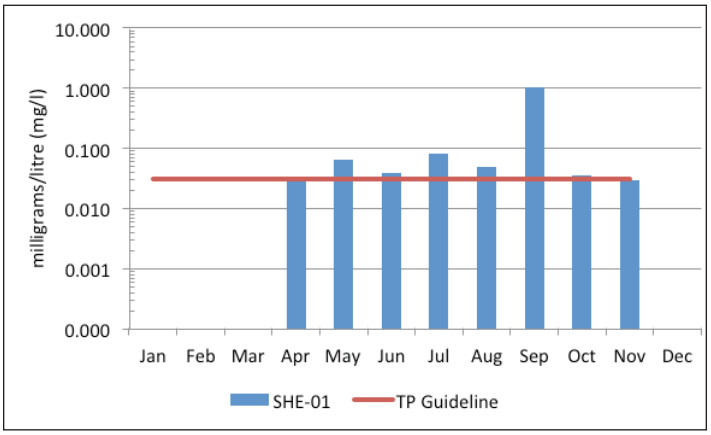


Figure 16 Total phosphorus concentrations in Sheldons Creek from 2008-2013

[3] No Ontario guideline for TKN is presently available; however, waters not influenced by excessive organic inputs typically range from 0.100 to 0.500 mg/l, Environment Canada (1979) Water Quality Sourcebook, A Guide to Water Quality Parameters, Inland Waters Directorate, Water Quality Branch, Ottawa, Canada

TKN results show that the bulk of results exceeded the guideline (Figures 17 and 18); 22 percent of samples were below the guideline in the 2002-2007 period and declined to only three percent in the 2008-2013 period. The average concentration was generally elevated and increased from 1.251 mg/l to 1.625 mg/l.

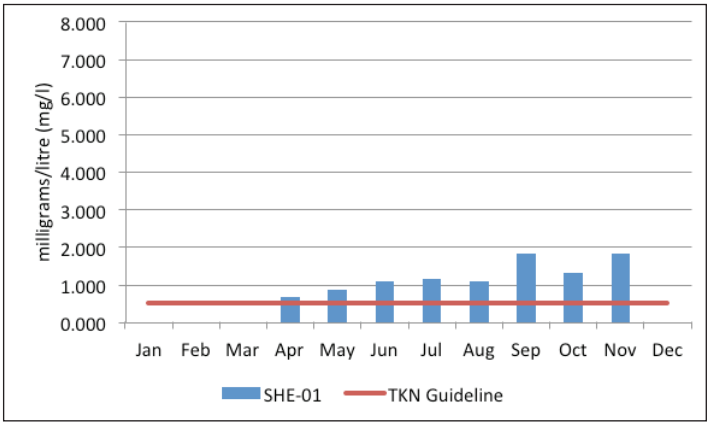


Figure 17 Total Kjeldahl nitrogen concentrations in Sheldons Creek from 2002-2007

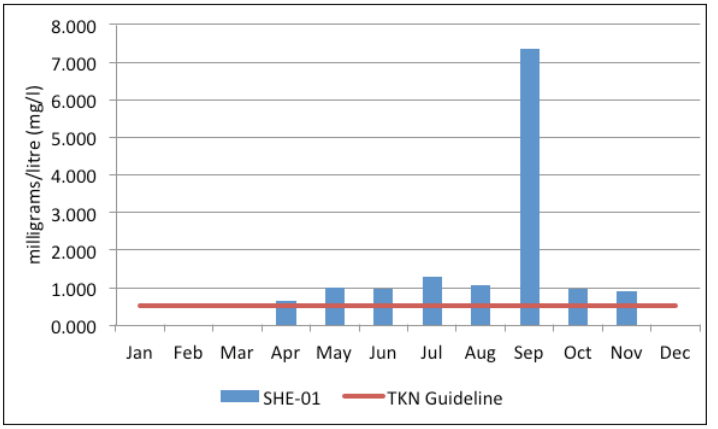


Figure 18 Total Kjeldahl nitrogen concentrations in Sheldons Creek from 2008-2013

The trend of elevated nutrients is also observed in NH3 data, as results at this site were generally above the guideline of 0.020 mg/l (Figures 19 and 20); the proportion of samples below the guideline improved from 25 percent to 56 percent. However, as observed with TP and TKN, this was accompanied by an increase in the average concentration from 0.051 mg/l (2002-2007) to 0.062 mg/l (2008-2013).

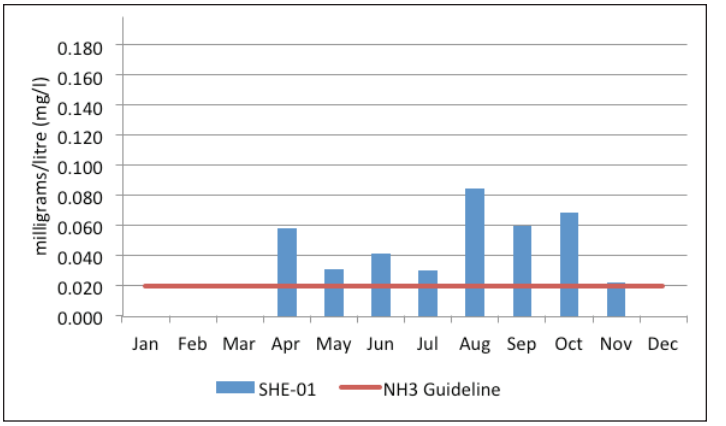


Figure 19 Ammonia concentrations in Sheldons Creek from 2002-2007

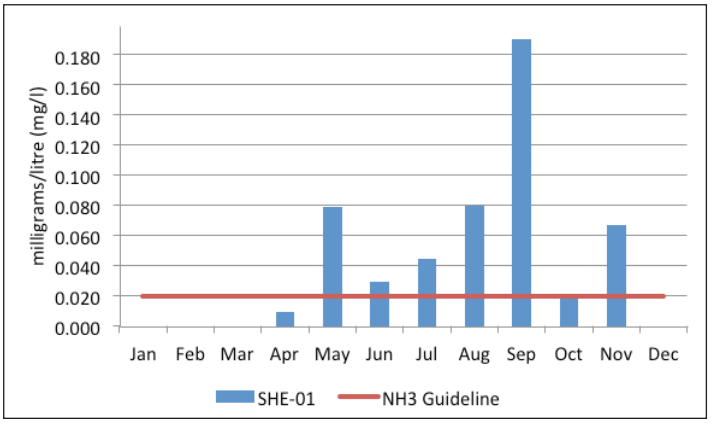


Figure 20 Ammonia concentrations in Sheldons Creek from 2008-2013

Summary

The data shows that nutrient enrichment continues to be a concern in Sheldons Creek. This creek was previously identified as having high TP concentrations *(Rideau Lakes Watershed Plan, 2009)* and elevated concentrations across all nutrient parameters continue to be observed. Elevated nutrients may result in nutrient loading to the inlet of Big Rideau known at Little Lake. High nutrient concentrations can help stimulate the growth of algae blooms and other aquatic vegetation in a waterbody and deplete oxygen levels as the vegetation dies off. Given the particularly high results this site should be further investigated to determine if sources of nutrients inputs can be reduced to improve water quality or if natural sources contribute to high background concentrations. Possible strategies to reduce nutrient inputs may include diversion of runoff and enhanced shoreline buffers.

E. coli

E. coli is used as an indicator of bacterial pollution from human or animal waste; in elevated concentrations it can pose a risk to human health. The PWQO of 100 colony forming units/100 milliliters (CFU/100 ml) is used to assess *E. coli*. Counts greater than this guideline indicate that bacterial contamination may be a problem within a watercourse.

Table 10 summarizes the geometric mean[4] for the monitored site on Sheldons Creek and shows the proportion of samples that meet the *E. coli* guideline of 100 CFU/100 ml. The results of the geometric mean with respect to the guideline for the two periods, 2002-2007 and 2008-2013, are shown in Figures 21 and 22 respectively.

Table 10 Summary of *E. coli* results for Sheldons Creek from 2002-2007 and 2008-2013

***E. coli* 2002-2007**			
Site	**Geometric mean (CFU/100ml)**	**Below Guideline**	**No. Samples**
SHE-01	45	70%	33
E. coli 2008-2013			
No. Samples	**Geometric mean (CFU/100ml)**	**Below Guideline**	**No. Samples**
SHE-01	45	79%	39

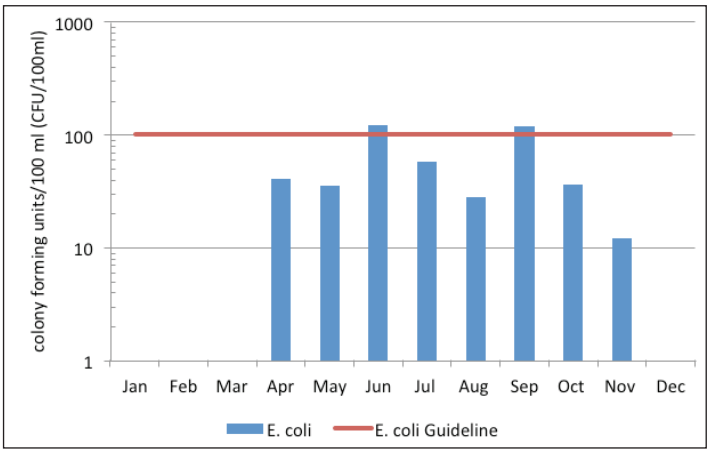


Figure 21 *E. coli* counts in Sheldons Creek 2002-2007

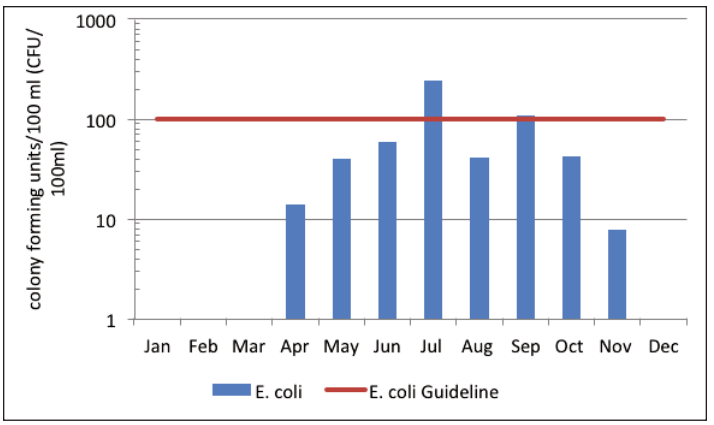


Figure 22 *E. coli* counts in Sheldons Creek 2008-2013

E. coli counts at site SHE-01 indicate a slight improvement with regard to bacterial contamination. The proportion of samples below the guideline increased from 70 percent (Figure 21) to 79 percent (Figure 22) and the count at the geometric mean was consistent at 45 CFU/100ml for both time periods.

Summary

The results indicate that bacterial contamination is not a significant problem in Sheldons Creek. The majority of counts are below the PWQO and the count at the geometric mean has not increased and is also well below the PWQO.

[4] A type of mean or average, which indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). It is often used to summarize a variable that varies over several orders of magnitude, such as *E. coli* counts.

2. Riparian Conditions

Shoreline Buffer Land Cover Evaluation

The riparian or shoreline zone is that special area where the land meets the water. Well-vegetated shorelines are critically important in protecting water quality and creating healthy aquatic habitats, lakes and rivers. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat in streams. Well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water. A recommended target (from Environment Canada's Guideline: *How Much Habitat is Enough?)* is to maintain a minimum 30 meter wide vegetated buffer along at least 75 percent of the length of both sides of rivers, creeks and streams.

Figure 23 shows the extent of the naturally vegetated riparian zone in the catchment, 30 meters along the shoreline of waterbodies and watercourses. This analysis from the RVCA's Land Cover Classification Program (derived from 2008 DRAPE imagery) shows that the riparian buffer (30 metre wide strip) in the catchment is comprised of woodland (48 percent), wetland (37 percent), settlement areas (nine percent), crop and pastureland (four percent), and transportation routes (two percent). Around **Big Rideau Lake** itself (in the catchment), the shoreline buffer is made up of woodland (69 percent), settlement areas (24 percent), wetland (four percent), transportation routes (two percent) and crop and pastureland (one percent).

Along streams in the catchment, the riparian buffer is comprised of wetland (52 percent), woodland (35 percent), crop and pastureland (nine percent), settlement areas (two percent) and transportation routes (two percent).

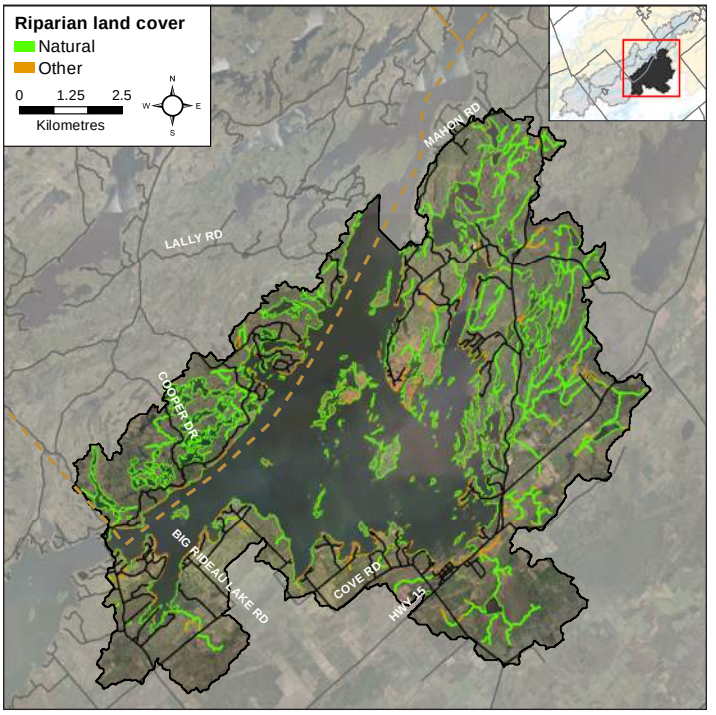


Figure 23 Natural and other riparian land cover around Big Rideau Lake

Headwaters Drainage Features Assessment

The RVCA Stream Characterization program assessed Headwater Drainage Features for the Rideau Lakes subwatershed in 2013. This protocol measures zero, first and second order headwater drainage features (HDF). It is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within headwater drainage features (HDF). RVCA is working with TRCA and the OMNRF to implement the protocol with the goal of providing standard datasets to support science development and monitoring on both the interim guideline for headwater drainage features and existing mitigation strategies. An HDF is a depression in the land that conveys surface flow. Additionally, this module provides a means of characterizing the connectivity, form and unique features associated with each HDF (OSAP Protocol, 2013). An initiative is underway to evaluate how these data can help understand the cumulative contributions of individual headwater drainage features on the downstream watershed state (see Stanfield et al., 2013). In 2013 the program sampled 20 sites in the Big Rideau Lake-Portland catchment. Figure 24 shows the headwater drainage features sampling locations in the catchment.

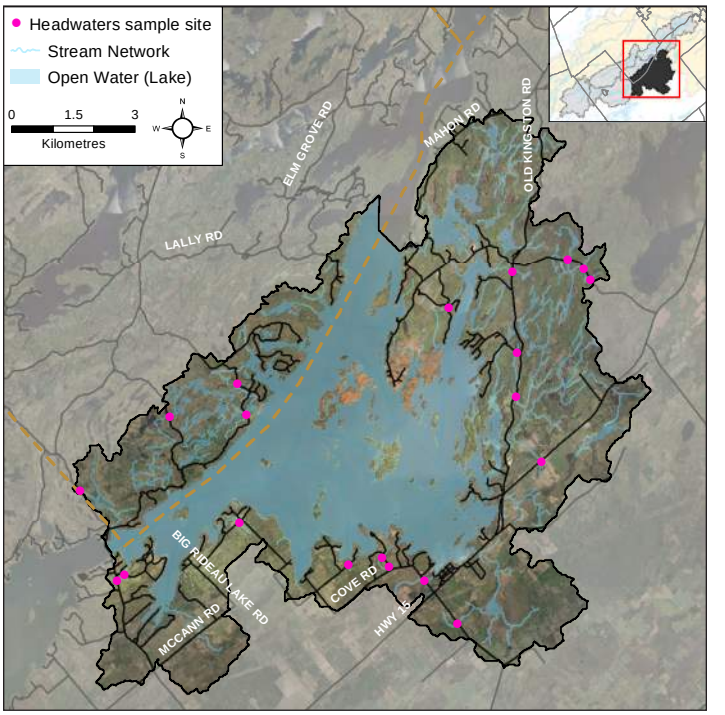


Figure 24 Headwater drainage feature sampling locations around Big Rideau Lake

Two headwater drainage features sampled in the Big Rideau Lake-Portland catchment

Fisheries

The Big Rideau Lake-Portland catchment is comprised of a mixed fish community of warm, cool and cold water species. A total of 27 species of recreational and baitfish support the Rideau Lakes fishery. The following is a list of known species in the catchment (Source: OMNRF/RVCA). Fish sampling sites are shown in Figure 25.

lake trout
northern pike
smallmouth bass
largemouth bass
walleye
yellow perch
rock bass
black crappie
pumpkinseed
bluegill
brown bullhead
yellow bullhead
white sucker
lake whitefish
lake herring
fallfish
shorthead redhorse
blackchin shiner
burbot
brook silverside
alewife
bluntnose minnow
banded killifish
golden shiner
blacknose shiner
fathead minnow
iowa darter

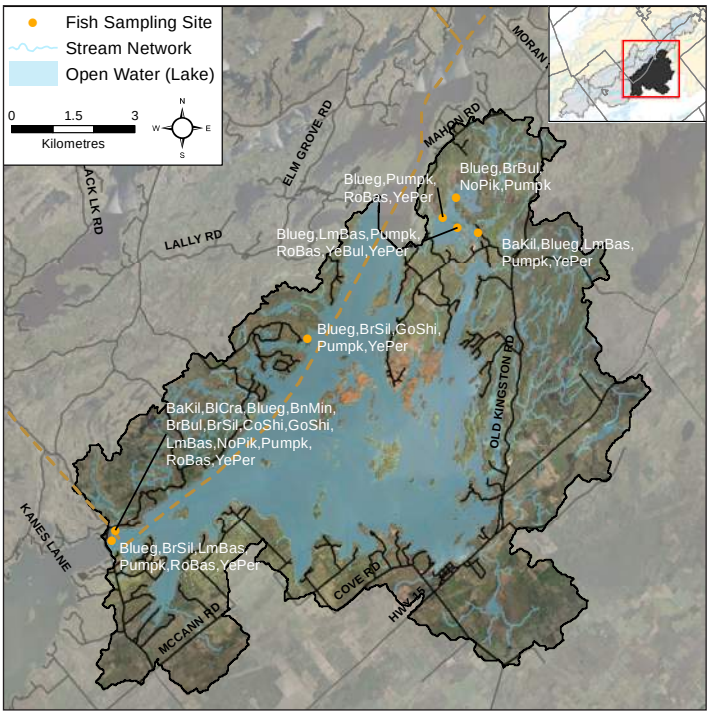


Figure 25 Fish sampling on Big Rideau Lake

Photo Credit OMNRF: Lake Trout *(Salvelinus namaycush)*

Black Crappie *(Pomoxis nigromaculatus)*

3. Land Cover

Woodland is the dominant land cover type in the catchment along with water, as shown in Table 11 and displayed in the map on the front cover of the report.

Table 11 Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Woodland*	3897	38
Water	3280	30
Wetland**	1572	15
Crop & Pasture	1288	12
Settlement	394	4
Transportation	296	3

* Does not include treed swamps ** Includes treed swamps

Woodland Cover

The Big Rideau Lake-Portland catchment contains 3897 hectares of upland forest and 194 hectares of lowland forest (treed swamps) (Fig.26) that occupies 38 percent of the drainage area (versus the 44 percent of woodland cover in the Rideau Lakes subwatershed). This figure is greater than the 30 percent of woodland area required to sustain forest birds, according to Environment Canada's Guideline: "How Much Habitat is Enough?" When forest cover declines below 30 percent, forest birds tend to disappear as breeders across the landscape.

Two hundred and sixty two (56 percent) of the 470 woodland patches in the catchment are very small, being less than one hectare in size. Another 171 (36 percent) of the wooded patches ranging from one to less than 20 hectares in size tend to be dominated by edge-tolerant bird species. The remaining 37 (eight percent of) woodland patches range between 20 and 287 hectares. Twenty-five of these patches contain woodland between 20 and 100 hectares and may support a few area-sensitive species and some edge intolerant species, but will be dominated by edge tolerant species. Conversely, 12 (two percent) of the 470 woodland patches in the drainage area exceed the 100 plus hectare size needed to support most forest dependent, area sensitive birds and are large enough to support approximately 60 percent of edge-intolerant species. Four of these patches top 200 hectares, which according to the Environment Canada Guideline will support 80 percent of edge-intolerant forest bird species (including most area sensitive species) that prefer interior forest habitat conditions.

Forest Interior

The same 470 woodlands contain 171 forest interior patches (Fig.26) that occupy four percent (402 ha.) of the catchment land area (versus the five percent of interior forest in the Rideau Lakes subwatershed). This is below the ten percent figure referred to in the Environment Canada Guideline that is considered to be the minimum threshold for supporting edge intolerant bird species and other forest dwelling species in the landscape. Most patches (162) have less than 10 hectares of interior forest, 105 of which have small areas of interior forest habitat less than one hectare in size. Another seven patches contain between 10 and 30 hectares of interior forest. Conversely, two patches have greater than 30 hectares of interior forest (at 40 and 41 ha.).

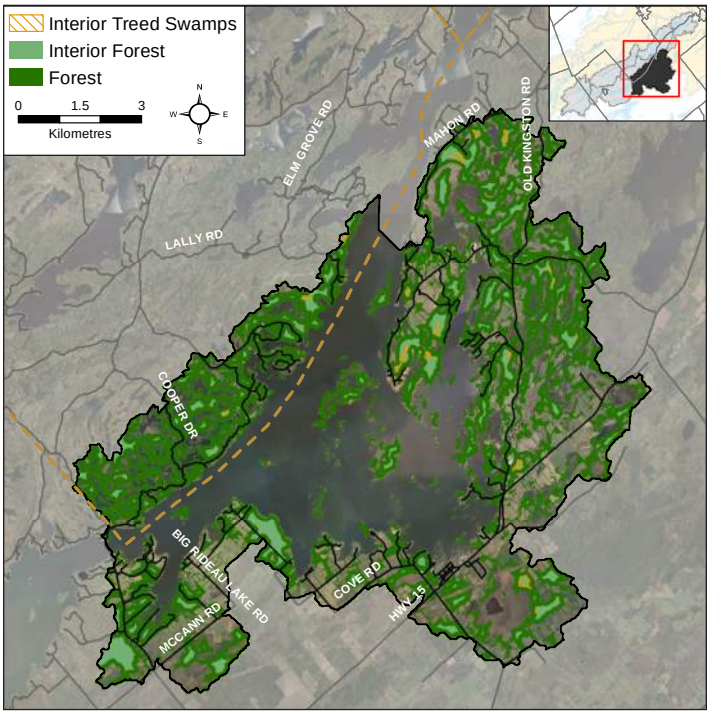
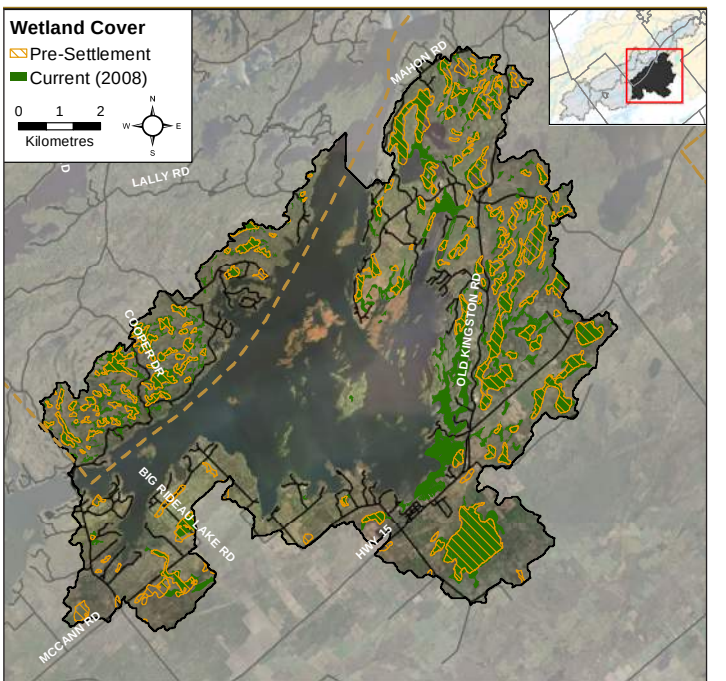


Figure 26 Catchment woodland cover and forest interior

Wetland Cover

Figure 27 shows pre-settlement versus current (2008) wetland cover in the catchment.



Pre-Settlement data provided by: Ducks Unlimited Canada, 2010. Southern Ontario Wetland Conversion Analysis, http://www.ducks.ca/aboutduc/news/archives/prov2010/pdf/duc_ontariowca.pdf, (March 2010)

Figure 27 catchment wetland cover

4. Stewardship and Protection

The RVCA and its partners are working to protect and enhance environmental conditions in the Rideau Lakes subwatershed.

Rural Clean Water Projects

Figure 28 shows the location of all Rural Clean Water Projects in the Big Rideau-Portland drainage area. From 2008 to 2013, landowners completed 15 projects: seven septic system repairs/replacements, two well upgrades, two well decommissionings, two erosion control projects, one well replacement and one education initiative. RVCA contributed $19,738 in grant dollars towards the total project cost of $96,531.

Prior to 2008, the RVCA completed seven projects in the area consisting of three well upgrades, two septic system repairs/replacements, one erosion control project and one education initiative. In total, RVCA contributed $7,187 in grant dollars to projects valued at $22,800.

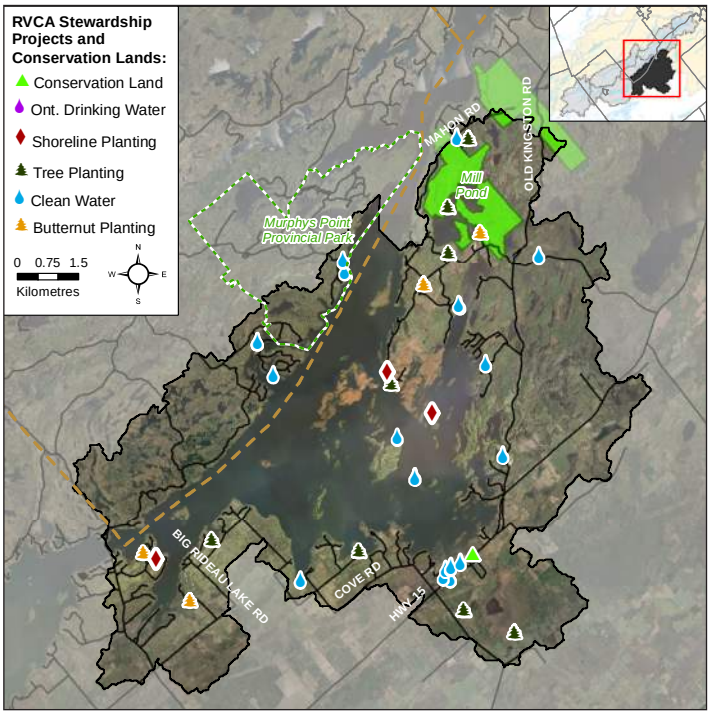


Figure 28 RVCA stewardship program project locations

Tree Planting Projects

The location of all tree planting projects is also shown in Figure 28. From 2008 to 2013, 10,300 trees were planted at one site through the RVCA Tree Planting Program. Project value is $28,313 with $18,333 of that amount coming from other fundraising sources.

Before that, landowners helped plant 8,600 trees, valued at $5,985, at seven project sites, using the RVCA Tree Planting Program; fundraising dollars accounted for $1,490 of that amount.

Shoreline Naturalization Projects

With the assistance of the RVCA's Shoreline Naturalization Program (see Fig.28), 715 trees and shrubs were planted at four project locations from 2008 to 2013 to create 253 metres of shoreline buffer at a total project value of $3,362.

Septic System Re-Inspections

From 2009 to 2013, the Mississippi Rideau Septic System Office performed 97 septic system re-inspections (84 cottages, 12 houses and one business) on Big Rideau Lake in Tay Valley Township within the Portland catchment. Remedial/maintenance work (i.e. pump outs, baffle replacement, work that generally does not require a permit) was recommended for 47 (or 48 percent) of those properties that were inspected, septic system replacements at another three (or three percent of) properties with more information provided to a further nine landowners with identified septic system concerns.

From 2009 to 2012, the Mississippi Rideau Septic System Office performed 76 septic system re-inspections (55 cottages, 19 houses, one business and one trailer park) on Big Rideau Lake in the Township of Rideau Lakes within the Portland catchment. Remedial/maintenance work (i.e. pump outs, baffle replacement, work that generally does not require a permit) was recommended for 32 (or 42 percent) of those properties that were inspected, septic system replacements at another four (or five percent of) properties with more information provided to one other landowner with identified septic system concerns (a further eight properties with concerns do not have any prescribed measures attached to them).

Valley, Stream, Wetland and Hazard Land Regulation

Twenty-nine square kilometres or 27 percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.29), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

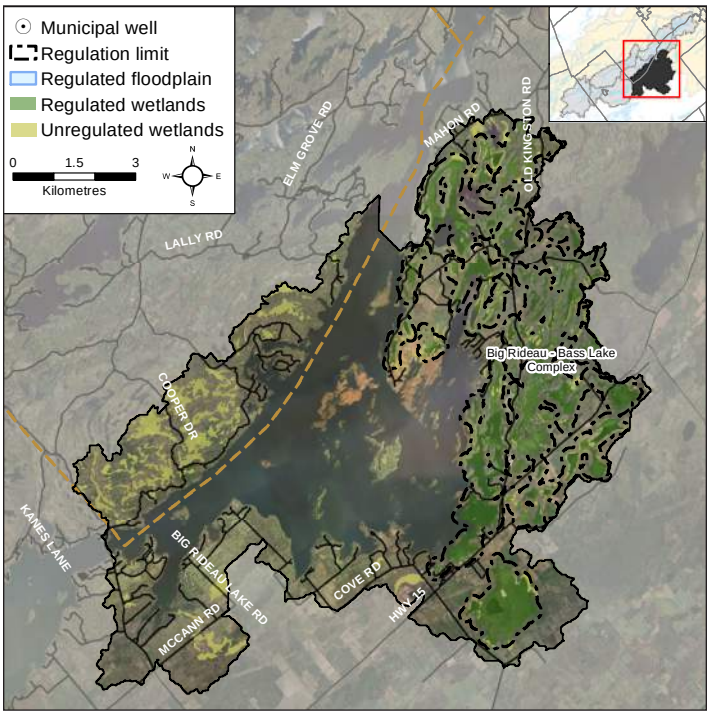


Figure 29 RVCA regulation limits

Natural features within the regulation limit include 10.3 sq. km. of wetlands (representing 66 percent of all wetlands in the catchment) and 78.5 kilometers of streams (representing 45 percent of all streams in the catchment). Some of these regulated watercourses (59.5 km or 34 percent of all streams) flow through regulated wetlands.

Regulation limit mapping has been plotted along 19 km (or 24 percent) of the streams that are outside of wetlands. Plotting of the regulation limit on the remaining 97.3 km (or 55 percent) of streams requires identification of flood and erosion hazards and valley systems.

Within the regulation limit, “development” and “site alteration” require RVCA permission. The “alteration to waterways” provision of Ontario Regulation 174/06 applies to all watercourses.

Vulnerable Drinking Water Areas

The catchment area is considered to have a Highly Vulnerable Aquifer. This means that the nature of the overburden (thin soils, fractured bedrock) does not provide a high level of protection for the underlying groundwater making the aquifer more vulnerable to contaminants released on the surface. The Mississippi-Rideau Source Protection Plan includes policies that focus on the protection of groundwater region-wide due to the fact that most of the region, which encompasses the Mississippi and Rideau watersheds, is considered Highly Vulnerable Aquifer.

The catchment area on the south side of Big Rideau Lake is also considered a Significant Groundwater Recharge Area. This means that there is a volume of water moving from the surface into the ground and groundwater serves either as a municipal drinking water source or supplies a cool/cold water stream. The Plan was not required to include policies to specifically address Significant Groundwater Recharge Areas.

Big Rideau Lake at Portland

5. Issues

Water Quality

- Sheldons Creek has a “Poor” surface water quality rating due to consistently high nutrient levels
- No biological water quality data is available to assess overall aquatic habitat conditions in Sheldons Creek
- RVCA’s 2013 Algae and Aquatic Plant Survey for Eastern Ontario Lakes and Rivers found that a majority of the survey respondents in the Rideau Lakes subwatershed have noticed an increase in algae and aquatic plants on their waterbody
- Fifty (of 97) Tay Valley Township septic system re-inspections conducted from 2009 to 2013 revealed the need for additional maintenance/remedial/replacement works to be performed. Those properties with concerns are identified in the yearly report submitted by the Mississippi Rideau Septic System Office to the Township
- Thirty six (of 76) Township of Rideau Lakes septic system re-inspections conducted from 2009 to 2013 revealed the need for additional maintenance/remedial/replacement works to be performed. Those properties with concerns are identified in the yearly report submitted by the Mississippi Rideau Septic System Office to the Township
- Construction of new septic systems along with the maintenance and operation of existing septic systems is often a challenge on the many islands that are located on Big Rideau Lake due to the complexities inherent in accessing waterfront properties along with the costs associated with such works

Development

- Traditional cottage character of the Rideau Lakes is being slowly altered by the scale of development and the trend toward larger year-round dwellings. This transition is taking place either through re-development of an existing cottage lot or incremental alterations (additions, sleeping cabins, gazebos, decks, sheds, boat houses, garages, lawns, docks)
- Many waterfront properties contain existing non-complying dwellings with respect to minimum water frontage and lot area and are often located within 30 metres of the water that require minor variances for expansion and/or reconstruction of dwellings where standard development setbacks from water are difficult to achieve. In these cases, of which there are many, municipal staff and the Conservation Authority often meet with resistance and push back when attempts are made to implement standards for development setbacks, vegetated shorelines and septic systems
- Monitoring implementation of conditions of planning and regulatory approvals is challenging due to a lack of resources
- Access to waterfront properties along private roads/rights-of-way is becoming more of a municipal liability for emergency vehicle access (ambulance, fire and police)

Shorelines

- No clear picture of the physical condition of the shoreline of Big Rideau Lake is available. Consideration should be given to conducting a shoreline survey of Big Rideau Lake using the MAPLE Shoreline Classification Survey (as has been done on Adam Lake and Upper Rideau Lake) to help assess its shoreline health
- Emerald ash borer poses a significant threat to the ecology of the subwatershed, given the prominence of ash trees along shorelines and in riparian and wetland areas. Many tree stands are predominantly ash and with their anticipated loss, it is unclear what will replace them and the overall effect of their collective demise on the physical and natural functions/values they provide for erosion, water quality and fish and wildlife habitat protection

Water Levels

- Fluctuations above/below the expected/typical range in water levels due to cool and wet or hot and dry conditions cause concern amongst property owners around the Rideau Lakes. Information about water level management is available on various websites; however, timely communication about the manipulation of water level control structures and specific conditions is not always forthcoming during high water events

Fisheries

- There is limited information available about the state of the fisheries resource in this catchment. Fisheries studies were completed on most Rideau Lakes in the late 1960s/early 1970s revealing a diverse fishery resource with cold, cool and warm aquatic habitats present. Since then, no other studies have been completed on the local lakes with the exception of Big Rideau Lake where landscape level, broad-scale, creel surveys are conducted by OMNRF on a five year cycle

Lake Planning

- This report outlines some issues and concerns regarding the health of the Big Rideau Lake-Portland catchment. However, there is limited knowledge of the overall issues and concerns about natural resource management, use and the health of the Big Rideau Lake and its watershed
- The Big Rideau Lake community might consider working together to undergo the lake planning process. The lake planning process allows for valuable information about the current health of the lake and its watershed, as well as an overview of all the issues and concerns facing the lake to be collected together. The lake planning process requires involvement and input from the whole lake community which includes lake residents, users, businesses, municipalities, non-governmental organizations, agency partners and other stakeholders. The process ensures that the lake community’s issues and concerns are gathered into one action-oriented document, which can guide the many stakeholders that care about Big Rideau Lake to help tackle lake health concerns in partnership

6. Opportunities

Water Quality

- Further investigate reported high nutrient levels in Sheldons Creek to determine if sources of nutrient inputs can be reduced to improve water quality
- Reduce pollutant loadings to Big Rideau Lake-Portland and Sheldons Creek through application of shoreline, stormwater and agricultural best management practices; also consider using low impact development (LID) methods to improve the quality and reduce the amount of stormwater runoff reaching the lake ecosystem. This may be particularly benificial in areas of high density development with extensive impervious surfaces (i.e., asphalt, concrete, buildings and severely compacted soils) or on sensitive waterfront properties (with steep slopes/banks, shallow/impermeable soils)
- Continue to promote the protection of the Rideau Lakes water resources through implementation of municipal and agency land use and development policies and practices
- Continue to promote septic sytem re-inspections by the Mississippi Rideau Septic System Office to ensure that sewage disposal systems are functioning properly and advocate for the replacement of faulty septic systems in accordance with current *Ontario Building Code* standards
- Continue to offer septic repair/replacement project funding provided by the Rideau Valley Rural Clean Water Program to waterfront landowners
- Continue efforts to educate boaters about the need to properly dispose of on-board grey and black water and the availability of environmentally conscious marinas with sewage pump-out facilities that have been certified by the Clean Marinas Program
- Review RVCA monitoring of surface water quality in the Big Rideau Lake, along with other Rideau Lakes before the next round of the Watershed Watch monitoring cycle begins in 2016 to determine if there is a need to "develop a more intensive and coordinated water quality monitoring program for all Rideau Lakes" (an identified action in the *2009 Rideau Lakes Watershed Plan)*
- Include Sheldons Creek in the RVCA Ontario Benthos Biomonitoring Network (OBBN) to sample bottom dwelling bugs (benthic invertebrates) to attain a more thorough understanding of its water quality and overall aquatic habitat conditions (using a biological method) to complement RVCA's baseline surface water quality (chemistry sampling) monitoring program

Development

- Collectively work with approval authorities (Tay Valley Township, Township of Rideau Lakes, Conservation Authority, Parks Canada, the Health Unit, and Mississippi-Rideau Septic System Office) to consistently implement current land use planning and development policies for water quality and shoreline protection (e.g., a minimum 30 metre development setback from water)
- Explore ways and means to more effectively enforce and implement conditions of land-use planning and development approval to achieve net environmental gains (particularly with respect to rehabilitating or protecting naturally vegetated shorelines and water quality)
- Encourage Committees of Adjustment to take advantage of technical and environmental information and recommendations forthcoming from planning and environmental professionals
- Municipal and agency planners together with development proponents are to continue using the *Rideau Lakes Basin Carrying Capacity Study* (1992) and associated 2014 *Site Evaluation Guidelines*[5] to inform decision-making about the application of development setbacks on lots with shallow soils/bedrock, steep slopes and sparse vegetation cover along with the use of the appropriate, development related, best management practices
- Utilize RVCA subwatershed and catchment reports to help develop/revise official plan policies to protect surface water resources and the natural environment (including woodlands, wetlands and shoreline cover)
- New development around Big Rideau Lake should take into account a first floor elevation of 124.81 metres (using the 124.51 metre 100 year flood elevation plus 0.3 metre freeboard) above sea level so as to ensure the safety and integrity of buildings and their contents and should also be taken into account in the design and placement of septic systems and well heads so that they are not adversely impacted during flood events

Shorelines

- RVCA and its partners (including the municipalities of Rideau Lakes and Tay Valley and the Big Rideau Lake Association) are to continue educating landowners about waterfront property best management practices with respect to shoreline use and development, septic system installation/maintenance and shoreline vegetation retention and enhancement
- Protect the riparian buffer along the shoreline of Big Rideau Lake and its tributaries during the development approvals process through adherence to and enforcement of municipal land-use policies and zoning standards
- Target shoreline restoration at sites identified in this report (as shown in Figure 23 as "Other" riparian cover) and explore restoration opportunities along the Sheldons Creek riparian corridor
- Consider a comprehensive assessment of shoreline conditions around Big Rideau Lake (using the MAPLE protocol) to monitor the effect of future changes to the lake ecosystem
- RVCA and partners are to continue promoting the RVCA's Shoreline Naturalization Program and other similar initiatives to enhance vegetation cover around Big Rideau Lake

Water Levels

- Forge connections amongst water resources management agencies, businesses, municipalities and lake residents to continually improve water level management activities. This will include the pooling of resources where possible and regular communications about how, when and why water levels are manipulated and what the impacts will be on navigation, fisheries, recreation and flood attenuation
- In 2014, lake levels were higher than most years and more attention was required from RVCA and municipal staff. Only general flood information was available for municipalities to address landowner concerns. In response, a review of the RVCA Flood Forecasting and Warning Program in the Upper Rideau Valley is underway to address this need

[5] Hutchinson Environmental Sciences Ltd. 2014. *Assessment of Municipal Site Evaluation Guidelines in Eastern Ontario's Lake Country.* Prepared for Mississippi Valley Conservation Authority, Rideau Valley Conservation Authority and Cataraqui Region Conservation Authority.

Fisheries

- Implement multiple objectives outlined in the Draft Fisheries Management Zone 18 Bass and Walleye Management Plans

Lake Planning

A Lake Plan:

- Is an action plan developed by a lake community (which includes lake residents, users, businesses, municipalities, non-governmental organizations, agency partners and other stakeholders) that identifies and preserves the natural and social characteristics that are valued by the lake community for future generations
- Helps to promote community discussion, education and action
- Sets goals and objectives for the protection and enhancement of the lake
- Recommends land use policies/practices that influence development on the lake
- Promotes stewardship actions to improve the environmental conditions of a lake so it can be enjoyed by future generations

Consider the need for a community-driven lake management plan for Big Rideau Lake that can:

- Bring the lake community together
- Engage the community beyond the lake residents and lake association members and develop partnerships
- Identify and bring together common values and concerns
- Provide a baseline of data on water quality, land-use activities, shoreline development, fisheries management, etc., that can help to inform water resources management, land use planning and stewardship actions
- Range in complexity from a comprehensive living document to a simplified list of priorities that can be carried out by the lake community to protect the lake environment